

# STATE OF ALASKA

## Cold Injuries Guidelines

Alaska Multi-level Version

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# ***STATE OF ALASKA***

## ***COLD INJURIES GUIDELINES***

### **INTRODUCTION**

These guidelines have been developed for use by prehospital, clinic and hospital personnel dealing with cold injuries in Alaska. They are meant to be guidelines, not absolute rules, governing the treatment of hypothermia, cold water near drowning, frostbite and avalanche burial.

Readers should note that these guidelines are primarily designed to be used in EMS education and as a reference for the treatment of cold injuries and for use in assisting in the development of local standing orders. In the absence of standing orders, they may be used to guide the treatment of cold injuries until communication with a physician is established.

These guidelines are **not** intended to serve as a comprehensive teaching document on cold-related illnesses and injuries. Consequently, those teaching the treatment of cold injuries must be prepared to elaborate on pathophysiology and treatment.

# HYPOTHERMIA

## *General Points*

- A. The evaluation and treatment of hypothermia whether wet or dry, on land or water, are similar. Specific differences are covered in the following pages.
- B. In the cold patient, a core temperature is one of the vital signs. In terms of the ABC's, think:
  - A-Airway
  - B-Breathing
  - C-Circulation
  - D-Diagnosis (Degrees)
- C. In the cold patient, body core temperature becomes an important sign. While obtaining a body core temperature is important and useful for assessing and treating hypothermia, there is tremendous variability in individual physiologic responses at specific temperatures and a low reading thermometer may not always be available. Therefore, these guidelines are not solely based on the patient's measured temperature. Core temperature<sup>1</sup> is best measured with an esophageal probe, if one is available and personnel have been trained in its insertion and use. If esophageal temperature monitoring is not available or appropriate, epitympanic or rectal temperature should be used.
- D. Assessment of temperature:
  - 1. The simplest assessment of a patient's body temperature may be performed by placing an ungloved hand against the skin of the patient's arm pit (axilla), back, or chest. If the skin feels warm, hypothermia is unlikely. This method, however, does not provide a reliable estimate of the patient's core temperature.
  - 2. Patients with cold skin should have a core temperature taken with a low reading thermometer. Household thermometers are useless in this setting. Low reading thermometers should be capable of measuring temperatures as low as 70°F (21 °C).
  - 3. Axillary and oral measurements are poor measures of core temperature, but may be used to rule out a diagnosis of hypothermia. Esophageal monitoring is the preferred method of monitoring temperature in hypothermic patients. Epitympanic, which differs from the tympanic devices used in many clinics, is second in order of preference. Rectal temperature lags significantly behind core temperature, but may be useful if esophageal or epitympanic temperature is not available. It is acknowledged that other methods of estimating the core temperature exist. Use of techniques other than esophageal measurements should be evaluated for their accuracy and practicality in the field. The decision to use a

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<sup>1</sup> Information about specific temperature measuring devices can be found on the CHEMS website:  
[www.chems.alaska.gov/EMS/coldinjuries/equip.htm](http://www.chems.alaska.gov/EMS/coldinjuries/equip.htm)

methodology other than esophageal temperatures should be made in consultation with the service's physician medical director.

CAUTION: Electronic thermometers may not be accurate if they are used in the cold. Cold shortens battery life, care must be taken that you have an alternate, non-battery dependent thermometer.

- E. The hypothermic patient should be assessed carefully for coexisting injuries and illnesses. The signs and symptoms of hypothermia may be mimicked by alcohol, diabetes, altitude sickness, overdose, exhaustion, and other conditions. As a result, a thorough assessment of the patient is imperative. Associated significant illness or injury may exacerbate hypothermia.
- F. If there is a fracture/dislocation associated with frostbite, the limb should be aligned in a **neutral position** (splinting in anatomic position; “make limbs look like limbs”) and splinted. Use caution to prevent additional injuries to frostbitten tissues. Splints should not be constrictive or restrict blood flow into the limb.
- G. Make every attempt to warm oxygen and fluids (both oral and IV) used for a hypothermic patient to at least the core temperature of the patient. (These fluids may be carried under the rescuers jackets). Fluids are given for volume expansion, not to warm the patient. It is better to give fluids as a bolus then saline lock the IV. Additional boluses can be given as needed.
- H. Since cold skin is easily injured, avoid direct application of hot objects or excessive pressure (e.g. uninsulated hot water bottles, BP cuffs, etc.).
- I. Chemical heat packs are ineffective in warming a patient. If the patient does not have frostbitten hands and feet, chemical hand warmers may be helpful in preventing further injury during transportation. Care should be taken with some chemical heat packs that may not have much total heat capacity but may burn the skin (i.e., surface temperature above 122 °F (50 °C)).
- J. Assume that the hypothermic patient can be resuscitated even if they appear to be beyond help because of skin color, pupil dilation, and depressed vital signs. Patients suffering from severe hypothermia have been resuscitated. It is also wise to be cautious about what is said during the resuscitation. Seemingly unconscious patients frequently remember what was said and done.
- K. Severe cold injuries are encountered relatively infrequently. Consequently, it is necessary that responders preplan the management of these conditions and that they are familiar with the appropriate equipment.
- L. The inside of the ambulance and any rooms where hypothermia patients are treated should be warm enough to prevent further heat loss, ideally above 80° F (27° C).
- M. Rescuers should follow state law and local standing orders. Generally, CPR should not be initiated if the patient:
  - has been submerged in cold water for more than 1 hour;
  - has a core temperature of less than 50° F (10° C);
  - has obvious fatal injuries, e.g. decapitation;
  - is frozen, e.g. ice formation in the airway;

- has a chest wall that is so stiff that compressions are impossible; or if
  - rescuers are exhausted or in danger
- N. An initial check for cardiac activity (or pulse) should be continued for 60 seconds when assessing a hypothermic patient or a patient who has been removed from cold water.
- O. If the patient is not breathing and has no pulse, give 3 minutes of ventilation. This may improve previously undetectable cardiovascular activity (i.e., increased pulse rate and/or increased blood pressure).
- P. Cardiac activity (or pulse) should then be checked again for 60 seconds before assuming no cardiac activity.

In the patient who is not breathing and has no pulse, the clinical decisions are based on access to transportation:

- If transportation is available within 3 hours, begin ventilation (intubate if possible), protect from further cooling, and do not start chest compressions. Wait for rescue crew. Starting chest compressions might precipitate ventricular fibrillation in a patient who actually has a weak pulse which is difficult to detect, but which might be providing adequate perfusion. If chest compressions cause ventricular fibrillation, this perfusion will be lost.
  - If transportation is not available within 3 hours begin ventilation (intubate if possible), start chest compressions and perform for up to 30 minutes while attempting to rewarm the patient. If this is unsuccessful in restoring spontaneous circulation, pronounce the patient dead.
  - CPR, while litter bearing, is not effective and should not be attempted.
- Q. In the State of Alaska, legislation (AS 18.08.089) has empowered EMTs, paramedics and physician assistants to declare death **in the field** following 30 minutes of properly performed advanced life support (ALS), even when the patient is hypothermic. If ALS is not available, current law requires EMTs to perform 60 minutes of cardiopulmonary resuscitation in conjunction with rewarming techniques on hypothermic patients prior to the declaration of death in the field. Please note that this legislation does not authorize Emergency Trauma Technicians and the general public to pronounce a patient dead.<sup>2</sup>
- R. The patient with severe hypothermia must be handled very gently. The cold heart is very prone to spontaneous ventricular fibrillation due to any disturbance or movement. Even cautious movement of the patient may induce ventricular fibrillation.
- S. An Automated External Defibrillator (AED) may be helpful to ascertain the presence or absence of ventricular fibrillation (cardiac activity). On AEDs, which do not display a tracing, the signal to shock means that the cardiac rhythm is either ventricular fibrillation or ventricular tachycardia. The signal not to shock may mean that the patient is in asystole or has a cardiac rhythm which would not benefit from defibrillation; this

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<sup>2</sup> AS 08.18.089 (d) (3) (B) defines “properly administered resuscitation efforts” as “when a person authorized to perform advanced cardiac life support techniques is not available and the patient is hypothermic, at least 60 minutes of cardiopulmonary resuscitation properly performed in conjunction with rewarming techniques as described in the current State of Alaska Hypothermia and Cold Water Near-Drowning Guidelines” NOTE: If a physician is available for consultation by radio or telephone, it is the physician, not the EMT, MICP, or PA who is pronouncing the patient and this statute does not apply.

includes pulseless electrical activity.

- T. When moving hypothermic patients by helicopter, care must be taken to protect the patient from additional exposure to cold due to the increased windchill caused by rotorwash. Rotorwash can be minimized if the helicopter shuts down while loading and unloading. If this is unsafe from an aviation standpoint, the patient must be packaged carefully to avoid any additional loss of heat or skin exposure that can cause or worsen frostbite and hypothermia.

### Classifications of Level of Hypothermia

Classifications	Core temp	Patient's ability to rewarm without external heat source	Clinical Presentation	
<b>Normal</b>	<b>Above 95 °F (35 °C)</b>		<b>Cold sensation shivering</b>	
Mild	95-90 °F (35-32 °C)	Good	Physical impairment <ul style="list-style-type: none"> <li>• Fine motor</li> <li>• Gross motor</li> </ul>	Mental impairment <ul style="list-style-type: none"> <li>• Complex</li> <li>• Simple</li> </ul>
<b>Moderate</b>	<b>90-82 °F (32-28 °C)</b>	Limited	<b>Below 86 °F (30 °C) degrees shivering stops loss of consciousness</b>	
<b>Severe</b>	Below 82 °C (28 °C)	Unable	Rigidity Vital signs reduced or absent Severe risk of mechanically-stimulated ventricular fibrillation (VF) (rough handling)	
	<b>Below 77 °F (25°C)</b>	Unable	<b>Spontaneous ventricular fibrillation (VF) Cardiac arrest</b>	

**Bold text** shows the major thresholds between stages of hypothermia

# HYPOTHERMIA

## General Public

### A. Assessment of Patient

1. Mild Hypothermia: A patient who is cold and has the following signs is considered to have mild hypothermia:
  - a. Vigorous shivering
  - b. Alert
  - c. May be ambulatory
2. Moderate or Severe Hypothermia – consistent with a temperature below 90 °F (32 °C). A patient who is cold and has any of the following signs or symptoms is considered to have moderate to severe hypothermia:
  - a. Depressed vital signs, such as a slow pulse and/or slow respiration.
  - b. Altered level of consciousness, including slurred speech, staggering gait, decreased mental skills, or the lack of response to verbal or painful stimuli.
  - c. No shivering in spite of being very cold. (Note: This sign is potentially unreliable and may be altered by alcohol intoxication.)

### B. Basic Treatment for Hypothermia

1. Prevent further heat loss:
  - a. Insulate from the ground;
  - b. Protect from the wind, eliminate evaporative heat loss by removing wet clothing (once the patient has adequate shelter);
  - c. Insulate the patient, including the head and neck;
  - d. Cover the patient with a vapor barrier (such as a blue tarp, a large piece of plastic, large garbage bags, etc.);
  - e. Move the patient to a warm environment; and
  - f. Consider covering patient's mouth and nose with a light fabric to reduce heat loss through respirations.
2. Activate the emergency medical services system to provide transport to a medical facility.
3. Do not give alcohol or permit patient to use tobacco.



C. Treatment for Mild Hypothermia

1. Treat the patient as outlined in Section B.
2. If there is no way to get to a medical facility, or if it will take more than 30 minutes for the patient to arrive at a medical facility, rewarm the patient with one or more of the following methods:
  - a. Insulate the patient (e.g. in a sleeping bag) and move to a warm environment;
  - b. Vigorous shivering is a very important method for increasing heat production. Shivering should be fueled by calorie replacement with fluid containing sugars (sugar content is more important than hot drinks);
  - c. Do not allow the patient to drink liquids unless the patient is capable of swallowing and protecting the airway.
  - d. Apply heat to areas of high surface heat transfer including the underarms, sides of the chest wall, the neck and groin;
  - e. Place the patient in a sleeping bag and provide close skin-to-skin contact with a warm body. The patient should **not** be placed in a sleeping bag with another individual who is hypothermic. This method may not speed core warming in a vigorously shivering patient but will slowly warm a non-shivering patient;
  - f. Consider a warm shower or a warm bath for the patient, if he or she is alert and mobile; and
  - g. Mild exercise, such as walking or stepping up and down on an object, will produce heat and may be helpful. This should only be conducted after the patient is dry and has been stable for at least 30 minutes.

D. Treatment for Moderate to Severe Hypothermia with Signs of Life (Pulse or Respirations):

1. Treat patients who are hypothermic very gently (do not rub or manipulate extremities, or attempt to remove wet clothes without cutting them off).
2. Treat the patient as outlined in sections B and C above with the following exceptions:
  - a. Do **not** allow the patient to sit or stand until rewarmed (do not put in shower or bath).
  - b. Do **not** give the patient oral fluids or food.
  - c. Do **not** attempt to increase heat production through exercise, including walking.
3. Reassess the patient's physical status periodically.
4. Transfer to a medical facility as soon as possible.

E. Treatment for Severe Hypothermia with No Life Signs:

1. Treat as above. Handle very carefully.

2. Check for respiration and signs of circulation (e.g. coughing, movement) for 60 seconds. If the patient is not breathing and does not have signs of circulation, give 3 minutes of ventilation (General Points N-P on page 6). Recheck for respiration and signs of circulation for a further 60 seconds. If the patient still is not breathing and does not have signs of circulation and there are no contraindications as listed in section M on page 5-6, start chest compressions only if transportation is not available within 3 hours (see P page 6).
3. Use mouth-to-mask breathing.
4. Reassess the patient's physical status periodically.
5. Transfer to a medical facility as soon as possible.

# HYPOTHERMIA:

## ***First Responder/Emergency Medical Technician-I<sup>3</sup>***

### A. Assessment of Patient

1. Mild Hypothermia: A patient who is cold and has the following signs is considered to have mild hypothermia:
  - a. Vigorous shivering
  - b. Alert
  - c. May be ambulatory
2. Moderate or Severe Hypothermia – consistent with a temperature below 90 °F (32 °C). A patient who is cold and has any of the following signs or symptoms is considered to have moderate to severe hypothermia:
  - a. Depressed vital signs, such as a slow pulse and/or slow respiration.
  - b. Altered level of consciousness, including slurred speech, staggering gait, decreased mental skills, or the lack of response to verbal or painful stimuli.
  - c. No shivering in spite of being very cold. (Note: This sign is potentially unreliable and may be altered by alcohol intoxication.)

### B. Basic Treatment for Hypothermia

1. Prevent further heat loss:
  - a. Insulate from the ground;
  - b. Protect from the wind, eliminate evaporative heat loss by removing wet clothing (once the patient has adequate shelter);
  - c. Insulate the patient, including the head and neck;
  - d. Cover the patient with a vapor barrier (such as a blue tarp, a large piece of plastic, large garbage bags etc.);
  - e. Move the patient to a warm environment; and
  - f. Consider covering patient's mouth and nose with a light fabric to reduce heat loss through respirations.
2. Activate the emergency medical services system to provide transport to a medical facility.
3. Do not give alcohol or permit patient to use tobacco.
4. Oxygen should be administered, if available. Oxygen should be heated to a maximum of 108°F (42°C) and humidified if possible. Heating oxygen without

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<sup>3</sup> Community Health Aides should use the protocols for their level of EMS certification. CHAs who are not certified as EMTs should use the EMT-I protocols for cold injuries.

humidification is not an effective warming technique.

5. Splinting should be performed, when indicated, in an anatomically neutral position if possible with caution to prevent additional injuries to frostbitten tissues.

C. Treatment for Mild Hypothermia

1. Treat the patient as outlined in Section B.
2. If there is no way to get to a medical facility, or if it will take more than 30 minutes for the patient to arrive at a medical facility, rewarm the patient with one or more of the following methods:
  - a. Insulate the patient (e.g. in a sleeping bag) and move to a warm environment;
  - b. Vigorous shivering is a very important method for increasing heat production. Shivering should be fueled by calorie replacement with fluid containing sugars (sugar content is more important than hot drinks);
  - c. Do not allow the patient to drink liquids unless the patient is capable of swallowing and protecting the airway.
  - d. Apply heat to areas of high surface heat transfer including the underarms, sides of the chest wall, the neck and groin;
  - e. Place the patient in a sleeping bag and provide close skin-to-skin contact with a warm body. The patient should **not** be placed in a sleeping bag with another individual who is hypothermic. This method may not speed core warming in a vigorously shivering patient but will slowly warm a non-shivering patient;
  - f. Consider a warm shower or a warm bath for the patient, if he or she is alert and mobile; and
  - g. Mild exercise, such as walking or stepping up and down on an object, will produce heat and may be helpful. This should only be conducted after the patient is dry and has been stable for at least 30 minutes.

D. Treatment for Moderate to Severe Hypothermia with Signs of Life (Pulse or Respirations):

1. Treat patients who are hypothermic very gently (do not rub or manipulate extremities, or attempt to remove wet clothes without cutting them off).
2. Obtain a core temperature as trained and authorized.
3. Treat the patient as outlined in sections B and C above with the following exceptions:
  - a. Do **not** allow the patient to sit or stand until rewarmed (do not put in shower or bath).
  - b. Do **not** give the patient oral fluids or food.
  - c. Do **not** attempt to increase heat production through exercise, including walking.

4. Reassess the patient's physical status periodically.
  5. Transfer to a medical facility as soon as possible.
- E. Treatment for Severe Hypothermia with No Life Signs:
1. Treat as above. Handle very carefully.
  2. Check for respiration and pulse for 60 seconds. If the patient is not breathing and has no pulse, give 3 minutes of ventilation (General Points N-P on page 6). Recheck for respiration and pulse for a further 60 seconds. If the patient still is not breathing and has no pulse and there are no contraindications as listed in section M on page 5-6, start chest compressions only if transportation is not available within 3 hours (see P page 6).
  3. Use mouth-to-mask breathing or bag and valve with oxygen at a reduced rate to prevent hyperventilation. Care must be taken not to hyperventilate the patient as hypocarbia can reduce the threshold for ventricular fibrillation in the cold heart. Consider ventilating the patient at 6 breaths per minute (half the normal rate).
  4. If the rescuers are authorized to use an automated external defibrillator and the device states that shocks are indicated, one set of three stacked shocks should be delivered. If the core temperature of the patient cannot be determined or is above 86 °F (30 °C), treat the patient as if normothermic. If the patient's core temperature is below 86 °F (30 °C), discontinue use of the AED after the initial three shocks until the patient's core temperature has reached 86 °F (30 °C).
  5. If CPR has been provided in conjunction with rewarming techniques for more than 30 minutes without the return of spontaneous pulse or respiration, contact the base physician for recommendations. If contact with a physician is not possible, Emergency Medical Technicians may consider terminating the resuscitation in 60 minutes in accordance with AS 18.08.089 and local protocols (see page 6, General Point Q).

# HYPOTHERMIA

## *Emergency Medical Technician-II*

### A. Assessment of Patient

1. Mild Hypothermia: A patient who is cold and has the following signs is considered to have mild hypothermia:
  - a. Vigorous shivering
  - b. Alert
  - c. May be ambulatory
2. Moderate or Severe Hypothermia – consistent with a temperature below 90 °F (32 °C). A patient who is cold and has any of the following signs or symptoms is considered to have moderate to severe hypothermia:
  - a. Depressed vital signs, such as a slow pulse and/or slow respiration.
  - b. Altered level of consciousness, including slurred speech, staggering gait, decreased mental skills, or the lack of response to verbal or painful stimuli.
  - c. No shivering in spite of being very cold. (Note: This sign is potentially unreliable and may be altered by alcohol intoxication.)

### B. Basic Treatment for Hypothermia

1. Prevent further heat loss:
  - a. Insulate from the ground;
  - b. Protect from the wind, eliminate evaporative heat loss by removing wet clothing (once the patient has adequate shelter);
  - c. Insulate the patient, including the head and neck;
  - d. Cover the patient with a vapor barrier (such as a blue tarp, a large piece of plastic, large garbage bags etc.);
  - e. Move the patient to a warm environment; and
  - f. Consider covering patient's mouth and nose with a light fabric to reduce heat loss through respirations.
2. Activate the emergency medical services system to provide transport to a medical facility.
3. Do not give alcohol or permit patient to use tobacco.
4. Oxygen should be administered, if available. Oxygen should be heated to a maximum of 108°F (42°C) and humidified if possible. Heating oxygen without humidification is not an effective warming technique.
5. Splinting should be performed, when indicated, in an anatomically neutral position if possible with caution to prevent additional injuries to frostbitten

tissues.

6. IV Therapy

- a. Indications for IVs are the same for mildly hypothermic patients as they are for normothermic patients.
- b. Most hypothermic patients are volume depleted and may require aggressive fluid resuscitation.
- c. Do not delay transport, communications, or other therapy by taking a long time to start an IV. IVs are difficult to start in cold patients.
- d. The recommended fluid for rehydration is normal saline. Bolus therapy is preferred to continuous drip. Give the patient a 250 cc bolus then either saline lock the IV (preferred) or decrease the fluid to TKO. Additional boluses can be delivered as needed to moderate underlying tachycardia.
- e. IVs should be heated to approximately 104° - 108° F (40°– 42° C), when possible, but should be no colder than the patient's core temperature.

7. Medications:

- a. Indications for medications are the same for mildly hypothermic patients as they are for normothermic patients.
- b. Medications are inefficient and poorly metabolized in the moderate-to-severely hypothermic patient. In addition, due to delayed metabolism, medications given in normal therapeutic doses to severely hypothermic patients can result in toxicity when the patient is rewarmed.

C. Treatment for Mild Hypothermia

1. Treat the patient as outlined in Section B.
2. If there is no way to get to a medical facility, or if it will take more than 30 minutes for the patient to arrive at a medical facility, rewarm the patient with one or more of the following methods:
  - a. Insulate the patient (e.g. in a sleeping bag) and move to a warm environment;
  - b. Vigorous shivering is a very important method for increasing heat production. Shivering should be fueled by calorie replacement with fluid containing sugars (sugar content is more important than hot drinks);
  - c. Do not allow the patient to drink liquids unless the patient is capable of swallowing and protecting the airway.
  - d. Apply heat to areas of high surface heat transfer including the underarms, sides of the chest wall, the neck and groin;
  - e. Place the patient in a sleeping bag and provide close skin-to-skin contact with a warm body. The patient should **not** be placed in a sleeping bag with another individual who is hypothermic. This method may not speed core warming in a vigorously shivering patient but will slowly warm a non-shivering patient;

- f. Consider a warm shower or a warm bath for the patient, if he or she is alert and mobile; and
  - g. Mild exercise, such as walking or stepping up and down on an object, will produce heat and may be helpful. This should only be conducted after the patient is dry and has been stable for at least 30 minutes.
- D. Treatment for Moderate to Severe Hypothermia with Signs of Life (Pulse or Respirations):
  1. Treat patients who are hypothermic very gently (do not rub or manipulate extremities, or attempt to remove wet clothes without cutting them off).
  2. Obtain a core temperature as trained and authorized.
  3. Treat the patient as outlined in sections B and C above with the following exceptions:
    - a. Do **not** allow the patient to sit or stand until rewarmed (do not put in shower or bath).
    - b. Do **not** give the patient oral fluids or food.
    - c. Do **not** attempt to increase heat production through exercise, including walking.
  4. Administer 250 cc boluses of a Normal Saline solution as needed to resolve tachycardia. IVs should be heated to approximately 104° - 108° F (40°– 42° C), when possible.
  5. Reassess the patient's physical status periodically.
  6. Transfer to a medical facility as soon as possible.
- E. Treatment for Severe Hypothermia with No Life Signs:
  1. Treat as above. Handle very carefully.
  2. Check for respirations and pulse for at least 60 seconds. If the patient is not breathing and has no pulse, give 3 minutes of ventilation (General Points N-P on page 6). Recheck for pulse and respiration for a further 60 seconds. If the patient still is not breathing and has no pulse and there are no contraindications as listed in section M on page 5-6, start chest compressions only if transportation is not available within 3 hours (see P page 6).
  3. Use mouth-to-mask breathing or bag and valve with oxygen at a reduced rate to prevent hyperventilation. Care must be taken not to hyperventilate the patient as hypocarbia can reduce the threshold for ventricular fibrillation in the cold heart. Consider ventilating the patient at 6 times/minute (half the normal rate).
  4. Advanced airway devices: The indications and contraindications for advanced airway devices are the same in both the hypothermic and the warm patient. The patient should be adequately ventilated and pre-oxygenated for 3 minutes prior to the intubation attempt. Intubation should only be attempted under optimum conditions by skilled personnel. Avoid hyperventilation in the hypothermic patient.
  4. If the rescuers are authorized to use an automated external defibrillator and the



device states that shocks are indicated, one set of three stacked shocks should be delivered. If the core temperature of the patient cannot be determined or is above 86 °F (30 °C), treat the patient as if normothermic. If the patient's core temperature is below 86 °F (30 °C), discontinue use of the AED after the initial three shocks until the patient's core temperature has reached 86 °F (30 °C).

5. If CPR has been provided in conjunction with rewarming techniques for more than 30 minutes without the return of spontaneous pulse or respiration, contact the base physician for recommendations. If contact with a physician is not possible, Emergency Medical Technicians may consider terminating the resuscitation in 60 minutes in accordance with AS 18.08.089 and local protocols (see page 6, General Point Q).

# HYPOOTHERMIA:

## *Emergency Medical Technician-III/Paramedic*

### A. Assessment of Patient

1. Mild Hypothermia: A patient who is cold and has the following signs is considered to have mild hypothermia:
  - a. Vigorous shivering
  - b. Alert
  - c. May be ambulatory
2. Moderate or Severe Hypothermia – consistent with a temperature below 90 °F (32 °C). A patient who is cold and has any of the following signs or symptoms is considered to have moderate to severe hypothermia:
  - a. Depressed vital signs, such as a slow pulse and/or slow respiration.
  - b. Altered level of consciousness, including slurred speech, staggering gait, decreased mental skills, or the lack of response to verbal or painful stimuli.
  - c. No shivering in spite of being very cold. (Note: This sign is potentially unreliable and may be altered by alcohol intoxication.)

### B. Basic Treatment for Hypothermia

1. Prevent further heat loss:
  - a. Insulate from the ground;
  - b. Protect from the wind, eliminate evaporative heat loss by removing wet clothing (once the patient has adequate shelter);
  - c. Insulate the patient, including the head and neck;
  - d. Cover the patient with a vapor barrier (such as a blue tarp, a large piece of plastic, large garbage bags etc.);
  - e. Move the patient to a warm environment; and
  - f. Consider covering patient's mouth and nose with a light fabric to reduce heat loss through respirations.
2. Activate the emergency medical services system to provide transport to a medical facility.
3. Do not give alcohol or permit patient to use tobacco.
4. Oxygen should be administered, if available. Oxygen should be heated to a maximum of 108°F (42°C) and humidified if possible. Heating oxygen without humidification is not an effective warming technique.
5. Splinting should be performed, when indicated, in an anatomically neutral

position if possible with caution to prevent additional injuries to frostbitten tissues.

6. IV Therapy

- a. Indications for IVs are the same for mildly hypothermic patients as they are for normothermic patients.
- b. Most hypothermic patients are volume depleted and may require aggressive fluid resuscitation.
- c. Do not delay transport, communications, or other therapy by taking a long time to start an IV. IVs are difficult to start in cold patients.
- d. The recommended fluid for rehydration is normal saline. Bolus therapy is preferred to continuous drip. Give the patient a 250 cc bolus then either saline lock the IV (preferred) or decrease the fluid to TKO. Additional boluses can be delivered as needed to moderate underlying tachycardia.
- e. IVs should be heated to approximately 104° - 108° F (40°– 42° C), when possible, but should be no colder than the patient's core temperature.

7. Medications:

- a. Indications for medications are the same for mildly hypothermic patients as they are for normothermic patients.
- b. Medications are inefficient and poorly metabolized in the moderate-to-severely hypothermic patient. In addition, due to delayed metabolism, medications given in normal therapeutic doses to severely hypothermic patients can result in toxicity when the patient is rewarmed.

C. Treatment for Mild Hypothermia

1. Treat the patient as outlined in Section B.
2. If there is no way to get to a medical facility, or if it will take more than 30 minutes for the patient to arrive at a medical facility, rewarm the patient with one or more of the following methods:
  - a. Insulate the patient (e.g. in a sleeping bag) and move to a warm environment;
  - b. Vigorous shivering is a very important method for increasing heat production. Shivering should be fueled by calorie replacement with fluid containing sugars (sugar content is more important than hot drinks);
  - c. Do not allow the patient to drink liquids unless the patient is capable of swallowing and protecting the airway.
  - d. Apply heat to areas of high surface heat transfer including the underarms, sides of the chest wall, the neck and groin;
  - e. Place the patient in a sleeping bag and provide close skin-to-skin contact with a warm body. The patient should **not** be placed in a sleeping bag with another individual who is hypothermic. This method may not speed core warming in a vigorously shivering patient but will slowly warm a non-shivering patient;

- f. Consider a warm shower or a warm bath for the patient, if he or she is alert and mobile; and
  - g. Mild exercise, such as walking or stepping up and down on an object, will produce heat and may be helpful. This should only be conducted after the patient is dry and has been stable for at least 30 minutes.
- D. Treatment for Moderate to Severe Hypothermia with Signs of Life (Pulse or Respirations):
1. Treat patients who are hypothermic very gently (do not rub or manipulate extremities, or attempt to remove wet clothes without cutting them off).
  2. Obtain a core temperature as trained and authorized. At this level, the esophageal probe is preferred. *NOTE: Esophageal probes are within the scope of practice for Paramedics in Alaska. Medical Directors who want the EMT-III's under their supervision to use esophageal probes must complete the requirements listed in 7 AAC 26.670 Approval of Additional Medications and Procedures.*
  3. Treat the patient as outlined in sections B and C above with the following exceptions:
    - a. Do **not** allow the patient to sit or stand until rewarmed (do not put in shower or bath).
    - b. Do **not** give the patient oral fluids or food.
    - c. Do **not** attempt to increase heat production through exercise, including walking.
  4. Administer 250 cc boluses of a Normal Saline solution as needed to resolve tachycardia. IVs should be heated to approximately 104° - 108° F (40° - 42° C), when possible.
  5. Reassess the patient's physical status periodically.
  6. Transfer to a medical facility as soon as possible.
- E. Treatment for Severe Hypothermia with No Life Signs:
1. Treat as above. Handle very carefully.
  2. Check for respiration and pulse for at least 60 seconds. If the patient is not breathing and has no pulse, give 3 minutes of ventilation (General Points N-P on page 6). Recheck for pulse and respiration for a further 60 seconds. If the patient still is not breathing and has no pulse and there are no contraindications as listed in section M on page 5-6, start chest compressions only if transportation is not available within 3 hours (see P page 6).
  3. Use mouth-to-mask breathing or bag and valve with oxygen at a reduced rate to prevent hyperventilation. Care must be taken not to hyperventilate the patient as hypocarbia can reduce the threshold for ventricular fibrillation in the cold heart. Consider ventilating the patient at half the normal rate (6 times/minute).
  4. Advanced airway devices: The indications and contraindications for advanced airway devices are the same in both the hypothermic and the warm patient. The patient should be adequately ventilated and pre-oxygenated for 3 minutes prior to

the intubation attempt. Intubation should only be attempted under optimum conditions by skilled personnel. Avoid hyperventilation in the hypothermic patient.

5. One series of defibrillation attempts if the patient is in ventricular fibrillation is reasonable. If successful the patient should be transported immediately to the nearest medical facility. If unsuccessful and the patient's core temperature is below 86° F (30 °C), the patient should immediately be transported to the nearest medical facility without further attempts at defibrillation. For every degree above 86 °F (30 °C), the likelihood of successful defibrillation increases. If the temperature is above 86° F (30 °C), continue with resuscitation as if the patient was normothermic. Additional treatment should be determined by the medical director. **Note: Shivering can mimic ventricular fibrillation.**
6. If the cardiac rhythm is asystole, as assessed in two different leads, do not attempt defibrillation.
7. If resuscitation has been provided in conjunction with rewarming techniques for more than 30 minutes without the return of spontaneous pulse or respiration, contact the base physician for recommendations. If contact with a physician is not possible, Emergency Medical Technicians may consider terminating the resuscitation in accordance with AS 18.08.089 and local protocols.

# HYPOTHERMIA

## *Small/Bush Clinic*

- A. The extent of the evaluation and treatment in small/bush clinics is defined by the training of the personnel and the available equipment.
- B. For transfer to a higher level medical facility, the patient must be stabilized in the clinic rather than transferred as an unstable patient. If the patient requires CPR or is otherwise unstable, send the necessary equipment and trained personnel to the clinic, if not already there, to stabilize the patient for transfer to a higher level medical facility. This includes starting an IV, administration of oxygen, and use of a cardiac monitor
- C. Once the rewarming process has started in the clinic, it should be continued until transfer is possible and appropriate or the patient recovers.

# HYPOTHERMIA:

## *Hospital*

### A. General Points

1. The extent of the evaluation and treatment in a hospital is defined by the training of the personnel and the available equipment.
2. Transfers of hypothermic patients between hospitals should follow the same guidelines as any other patient transfer. It may be preferable to bypass a smaller community hospital to transport to a hospital that has cardiac by-pass capability. Consider early transport for individuals who have a core temperature at or below 68°F (20°C). If the systolic blood pressure is less than 60, consider placing the patient on cardiopulmonary bypass if available.

### B. Evaluation

1. Initial attention to the ABCs and resuscitation, including ACLS/ATLS, as needed.
2. Vital signs, including core temperature – esophageal probe is the preferred method.
3. Pertinent history.
4. Pertinent physical exam including:
  - a. Feel the skin for temperature.
  - b. Level of consciousness and neurological examination.
  - c. Cardiopulmonary exam.
  - d. Associated trauma.
5. Most hypothermia patients should receive:
  - a. Portable chest x-ray.
  - b. 12 lead electrocardiogram.
  - c. Blood tests: CBC, electrolytes, glucose
  - d. Arterial blood gases. (If obtained, use the uncorrected value, not the “temperature-corrected” value.)

### C. Monitoring and Treatment

1. Basic treatment is the same as that indicated for prehospital personnel in these guidelines.
2. Physiologic monitoring. Pulse oximetry or transcutaneous oxygen monitoring may be unreliable due to peripheral vasoconstriction. Consider topical methyl salicylate (found in products like BenGay®) as a skin vasodilator. All patients should be on a cardiac monitor. Monitor end-tidal CO<sub>2</sub>. Temperature should be monitored continuously from the esophageal probe.
3. Administer 250 cc or 20 cc/kg (for pediatric patients) normal saline as a bolus.

Repeat bolus administration of normal saline as clinically indicated. Large amounts of fluid may be necessary for complete volume resuscitation.

- a. A CVP line may help to determine fluid status. It may be preferable to keep the patient at a lower range during the resuscitation, especially in the early stages.
  - b. IVs should be heated to 104° - 108° F (40° - 42° C).
4. Insert a urinary bladder catheter
  5. Insert a nasogastric tube or orogastric tube, if the patient is unconscious and intubated.
  6. Ventilate with humidified air or oxygen heated to 104° - 108° F (40° - 42° C), measured at the mouth.
  7. Continue cardiovascular monitoring until stable and warm.
  8. Do not use sedation to suppress shivering for comfort concerns where hypothermia is the primary problem.

#### D. Adding Heat

1. There are many methods of rewarming hypothermic patients. Table 1: Rewarming Methods (on the next page) presents active external rewarming methods and active core rewarming methods. In general, methods are presented in order of preference and effectiveness. The choice of methods will depend on availability of equipment and the experience of the providers implementing the methods.



**TABLE 1: REWARMING METHODS**

<b>ACTIVE EXTERNAL REWARMING METHODS</b>		
Method	Notes	Patient Type
Forced air warming	High flow of warm air across the skin	All
Plumbed (water-filled) blankets	Use only if forced air is not available	All
Other external devices such as the Charcoal Heatpac (the Norwegian heater)	This device is primarily designed for field use	All
Warmed blankets	Blankets from a warmer	All
Warm (tub) bath	Water should be up to 100°F (37°C)	Mild hypothermia
AVA rewarming (arm/leg)	The lower arms and hands (distal to the elbow) and the lower legs and feet (distal to the knees) are immersed in water between 107-112°F (42-45 °C). This opens the arterio-venous anastomosis (AVA).	Mild hypothermia
<b>ACTIVE CORE REWARMING</b>		
Warm IV's	104° - 108°F (40° - 42°C)	All
Heated, humidified oxygen ventilation	104° - 108° F (40° - 42° C)	All
Peritoneal lavage	104° - 108° F (40° - 42° C) For further details about techniques, solutions and rates see Danzl <sup>5</sup>	Preferred invasive method for moderate-to-severe hypothermia
Chest lavage via chest tubes **	104° - 108° F (40° - 42° C) For further details about techniques, solutions and rates see Danzl	Used for moderate-to-severe hypothermia, less effective than peritoneal lavage.
Continuous arterio-venous rewarming (CAVR)	Blood from an arterial catheter runs through a warmer and returns to the body via a venous catheter.	Severe hypothermia with SBP greater than 60
Extracorporeal circulation (cardiac bypass)		Severe hypothermia with SBP less than 60

\*\* Chest tube lavage should only be used if placement of a chest tube has already be performed to relieve a pneumothorax.

<sup>5</sup> Danzl D.F. (2001) Accidental Hypothermia In P.S. Auerbach (Ed.) Wilderness Medicine (4<sup>th</sup> edition). Mosby: St. Louis. . 135-177.

2. Regardless of the method chosen for adding heat, the patient must be under physiologic control and the temperatures of devices, fluids, and gasses used for treatment should be monitored.
3. Warm (tub) bath is one of the most rapid external rewarming methods, but requires close physiological monitoring.
4. For Severe Hypothermia with Life Signs: Use the rewarming method available in the facility which is most familiar to you.
5. For Severe Hypothermia without Signs of Life: Warm the core using one or more of the internal methods, preferably cardiopulmonary bypass, if available.
6. Elderly people, or those who are malnourished and who are hypothermic, should not be warmed quickly (no faster than 0.5 °/hour) until after they are adequately ventilated.
7. Other devices may become available in the future; these will need to be evaluated before inclusion in these guidelines. One such device is the endovascular catheter, which is in development and may be an option for rewarming patients in the future.

#### E. Most Common Problems

1. Arrhythmias:
  - a. Supraventricular dysrhythmias will usually convert spontaneously with rewarming. Do not treat supraventricular dysrhythmias; continue efforts to warm the patient.
  - b. In ventricular fibrillation with a core temperature of less than 85° F (29 °C), consider giving one series of three shocks.
2. Volume Depletion: Monitor and treat accordingly.
3. Medications are poorly metabolized in hypothermic patients and are more highly protein bound. This makes them ineffective. Once the patient is rewarmed this may result in unwanted delayed effects and toxicity. Drug administration should generally be delayed until the patient has been rewarmed.
3. Monitor potassium and glucose and treat accordingly. Note: People who have been cold for a long time may have used up their insulin stores. If a patient is not shivering and has adequate glucose levels he or she may benefit from a small dose of insulin to stimulate movement of glucose into the cells.

#### F. Transferring Patients to Tertiary Care Facilities

1. Transfers of hypothermic patients between hospitals should follow the same guidelines as any other patient transfer. It may be preferable to bypass a smaller community hospital to transport to a hospital that has cardiac by-pass capability. Consider early transport for individuals who have a core temperature of 68°F (20°C) or below. If the blood pressure is less than 60, consider placing the patient on cardiopulmonary bypass if available.

2. The general indications to transfer the patient from a smaller hospital to a tertiary care facility are:
  - a. Lack of nursing and support staff.
  - b. Lack of equipment to properly provide for a critically ill patient.
3. Specifically, the patient should be transferred if there is:
  - a. No capability for arterial blood gas monitoring;
  - b. Profound neurological depression;
  - c. Associated significant trauma; or
  - d. Associated significant frostbite.
4. The patient should not be transferred until he or she has been accepted by the receiving medical facility and has been stabilized as much as possible to ensure safe transport.

G. Indications for stopping rewarming efforts:

1. A patient whose temperature does not rise despite aggressive rewarming is most likely dead
2. Serum potassium level greater than or equal to 10, if associated with asphyxia, (avalanche or drowning) is an indication of cell death.

# COLD WATER NEAR DROWNING

## *General Points*

- A. The use of personal floatation devices with thermal protection should be mandatory for emergency responders ANYTIME they work in, on or near the water.
- B. For the purposes of this document,
  - Cold water is defined as being less than 70° F (21° C)
  - Immersion – patient's head was above water
  - Submersion – patient's head was under water
- C. Any patient who was submerged and unconscious should be transported to a hospital, ***even if he or she has regained consciousness.***
- D. If a person has been under water for **LESS** than one hour, full resuscitative efforts should be employed. If a person has been under water for **MORE** than one hour, resuscitation efforts are usually unsuccessful, and should not be started.
- E. In the State of Alaska, legislation (AS 18.08.089) has empowered EMTs, paramedics and physician assistants to declare death **in the field** following 30 minutes of properly performed advanced life support (ALS), even when the patient is hypothermic. If ALS is not available, current law requires EMTs to perform 60 minutes of cardiopulmonary resuscitation in conjunction with rewarming techniques on hypothermic patients prior to the declaration of death in the field. Please note that this legislation does not authorize Emergency Trauma Technicians and the general public to pronounce a patient dead.
- F. If the length of time under water is unknown, it should be considered to have been less than one hour unless there are obvious signs of long submersion including slippage of skin or animal predation.
- G. There is generally no difference between fresh and salt water near drowning regarding outcome or treatment.
- H. If it does not delay rescue, maintain the patient's body in a horizontal position during removal from the water.
- I. These principles apply to any near drowning, not just those in cold water. The difference between warm and cold water is that in submersions greater than 6 minutes, the chance for survival in warm water is much less than in cold water. The colder the water, the better the chance for survival.
- J. Because severe hypothermia (core temperature below 82° F / 28° C) is uncommon in cold water near drowning, hypothermia is less critical than cardiopulmonary arrest. Rewarming is done to raise the temperature to make defibrillation more effective.
- K. Persons surviving a submersion episode should be transported to the nearest medical facility for further evaluation. Accumulation of fluid in the lungs (noncardiogenic pulmonary edema) may develop 6 - 24 hours after submersion.

# COLD WATER NEAR DROWNING

## ***General Public***

### Evaluation and Treatment

- A. Do not move the patient's head or neck if there is a possibility that the patient may have a neck injury (neck injuries are more common after diving into shallow water or when a boat strikes an object). If possible, remove the patient from the water on a backboard or keep the neck and back in a straight line.
- B. Activate the EMS system.
- C. Check for respirations and signs of circulation (e.g. coughing, movement) for 60 seconds.
- D. If the patient is not breathing and has no signs of circulation, start CPR immediately.
- E. It is very important to clear the airway with any of the standard maneuvers, but no specific maneuvers are mandatory to expel water from the lungs. Do not administer abdominal or chest thrusts on patients unless there is evidence of a solid foreign body airway obstruction.
- F. Assess carefully for associated injuries.
- G. Hypothermia, if present, should be treated in accordance with the Hypothermia Guidelines.

# COLD WATER NEAR DROWNING

## *First Responder/Emergency Medical Technician-I*

### Evaluation and Treatment

- A. Do not move the patient's head or neck if there is a possibility that the patient may have a neck injury (neck injuries are more common after diving into shallow water or when a boat strikes an object). If possible, remove the patient from the water on a backboard or keeping the neck and back in a straight line.
- B. Check for respiration and pulse for 60 seconds.
- C. If the patient is not breathing and has no pulse, start CPR immediately.
- D. It is very important to clear the airway with any of the standard maneuvers, but no specific maneuvers are mandatory to expel water from the lungs. Do not administer abdominal or chest thrusts on patients unless there is evidence of a solid foreign body airway obstruction.
- E. Assess carefully for associated injuries.
- F. Hypothermia, if present, should be treated in accordance with the Hypothermia Guidelines.

# COLD WATER NEAR DROWNING

*Emergency Medical Technician-II*  
*Emergency Medical Technician-III*  
*Paramedic*

## Evaluation and Treatment

- A. Do not move the patient's head or neck if there is a possibility that the patient may have a neck injury (neck injuries are more common after diving into shallow water or when a boat strikes an object). If possible, remove the patient from the water on a backboard or keeping the neck and back in a straight line.
- B. Check for respirations and pulse for 60 seconds.
- C. If the patient is not breathing and has no pulse, start CPR immediately.
- D. It is very important to clear the airway with any of the standard maneuvers, but no specific maneuvers are mandatory to expel water from the lungs. Do not administer abdominal or chest thrusts on patients unless there is evidence of a solid foreign body airway obstruction.
- E. Assess carefully for associated injuries.
- F. Hypothermia, if present, should be treated in accordance with the Hypothermia Guidelines.
  - a. If the main problem is not moderate or severe hypothermia, medication should be used as in the normothermic patient.
  - b. Because hypovolemia is generally not a problem in cold water near drownings, if IV access can be obtained, a saline lock or a balanced salt solution infused at a 'to keep open' rate is appropriate.
  - c. One series of defibrillation attempts if the patient is in ventricular fibrillation is reasonable. If successful the patient should be transported immediately to the nearest medical facility. If unsuccessful and the patient's core temperature is below 86° F (30 °C), the patient should immediately be transported to the nearest medical facility without further attempts at defibrillation. For every degree above 86 °F (30 °C), the likelihood of successful defibrillation increases. If the temperature is above 86° F (30 °C), continue with resuscitation as if the patient was normothermic. Additional treatment should be determined by the medical director. **Note: Shivering can mimic ventricular fibrillation.**
- G. In areas where access to cardiopulmonary bypass is quick, consider transporting the cold water near drowning patient to a facility with bypass capabilities.

# COLD WATER NEAR DROWNING

## *SMALL/BUSH CLINIC*

### Evaluation and Treatment

- A. The extent of the evaluation and treatment in small/bush clinics is defined by the training of the personnel and the available equipment as outlined in these guidelines.
- B. It is very important to clear the airway with any of the standard maneuvers, but no specific maneuvers are mandatory to expel water from the lungs. Do not administer abdominal or chest thrusts on patients unless there is evidence of a solid foreign body airway obstruction.
- C. Check for respiration and pulse for up to 60 seconds.
- D. If the patient is not breathing and has no pulse, start CPR immediately.
- E. Assess carefully for associated injuries.
- F. Follow the Small/Bush Clinic section on Hypothermia on page 22 for additional therapy as needed, with the following exceptions.
  - 1. If the main problem is not moderate or severe hypothermia, medication should be used as in the normothermic patient.
  - 2. Because hypovolemia is generally not a problem in cold water near drownings, a balanced salt solution should be infused at a 'to keep open' rate.



# COLD WATER NEAR DROWNING

## *Hospital*

### A. Evaluation

The evaluation of the cold water near drowning patient is similar to that indicated in the Hospital section of the hypothermia guidelines. Core temperature should be monitored with an esophageal probe. There use of tests in the cold water near drowning patient differs from those used in a patient with hypothermia. The general approach includes:

1. Cardiorespiratory monitoring.
2. Saline lock.
3. Arterial blood gases.
4. Chest x-ray.
5. 12 lead electrocardiogram.
6. BMP, CBC, coagulation profile and CPK.

### B. Therapy

1. Achieve spontaneous circulation as quickly as possible per ACLS guidelines.
2. Cardiopulmonary bypass, **when available**, is an appropriate therapy when the patient has resistant hypoxemia and cannot be rewarmed.
3. Rewarming. Active rewarming methods (warm air inhalation, external or internal heat sources) should be used as indicated by core (esophageal) temperature. Warming should cease when core temperature reaches 32-33 °C to maintain cold-induced brain protection in these patients.
4. Pulmonary complications should be managed using positive pressure ventilation.
5. Hematologic complications, including hemolysis and disseminated intravascular coagulation (DIC) should be treated in the usual manner.
6. Renal insufficiency - Treat as with any patient with renal insufficiency.

### C. Transferring the Near Drowning Patient to a Tertiary Care Facility

1. First the patient should be stabilized at the nearest hospital with intubation as necessary, and mechanical ventilation.
2. The general indications to transfer the patient from a small hospital to a tertiary care facility are lack of staff or equipment to continue caring for a critically ill patient.
3. Specific indications for transfer:
  - a. No capability for arterial oxygen monitoring;
  - b. Deterioration of pulmonary status;
  - c. Renal insufficiency;
  - d. Hemolysis;

- e. Profound neurological depression; and/or
- f. Significant associated trauma.

# FROSTBITE

## *Introduction*

Frostbite is the freezing of tissue and may involve only superficial tissues or may extend to the bone. The onset and severity of frostbite may be affected by air temperature, wind speed, duration of exposure, amount of exposed area, and predisposing conditions such as:

- Poor or inadequate insulation from the cold or wind;
- Immersion;
- Altitude;
- Impaired circulation from tight clothing or shoes;
- Fatigue;
- Injuries;
- Circulatory disease;
- Poor nutrition;
- Dehydration;
- Hypothermia;
- Alcohol or drug use; and
- Use of tobacco products.

Damage to the frostbitten tissues is caused by crystallization of water within the tissues, typically between the cells, and by resulting changes in electrolyte concentration within the cells. Damage occurs during the freezing process. Further damage occurs during reperfusion of frostbitten tissue.

Frostbite is frequently seen in Alaska, although, in most circumstances, the frostbite is superficial and treated by the patient at home. Occasionally, it is severe enough to warrant transport to a medical facility for evaluation and treatment. Seldom will it be necessary for emergency medical personnel to perform in-field rewarming for deep frostbite. It may, however, be necessary to treat patients with superficial frostbite who have sustained other injuries, (e.g. a motor vehicle crash patient who has been exposed to sub-zero temperatures while awaiting the arrival of rescue and medical personnel).

# FROSTBITE

## *General Points*

- A. Hypothermia and other life threatening conditions may be present in the patient with frostbite and must be evaluated and treated immediately.
- B. When caring for a patient in extremely cold temperatures, take great care to prevent hypothermia, tissues from becoming frostbitten, and already frostbitten tissues from becoming worse.
- C. If transporting a patient with frostbite which will not be rewarmed in the field, the medical provider should protect the frostbitten parts from additional injury and temperature changes.
- D. **Superficial frostbite** affects the dermis and shallow subcutaneous layers of the part exposed, and is recognized by white or gray colored patches. The affected skin feels firm, but not hard. The skin initially turns red and, once frostbitten, is not painful. No deep tissue loss will occur when treated with rapid rewarming.
- E. **Deep frostbite** affects the dermal and subdermal layers and may involve an entire digit or body part. The skin feels hard and cold and the affected tissue is white or gray. A pulse cannot be felt in the deeply frostbitten tissue and skin will not rebound when pressed.
- F. Large blisters on the frostbitten area indicate that deep frostbite has partially or totally thawed.
- G. Treatment of deep frostbite may be painful and is best accomplished in a medical facility. Before electing to rewarm frostbitten tissue in the field, advice should be sought by radio or telephone, if possible, from a physician who is knowledgeable about field treatment of frostbite.

**If transport time will be short (1-2 hours at most)**, the risks posed by improper rewarming or refreezing outweigh the risks of delaying treatment for deep frostbite.

**If transport will be prolonged (more than 1-2 hours)**, frostbite will often thaw spontaneously. It is more important to prevent hypothermia than to rewarm frostbite rapidly in warm water. This does not mean that a frostbitten extremity should be kept in the cold to prevent spontaneous rewarming. Anticipate that frostbitten areas will rewarm as a consequence of keeping the patient warm and protect them from refreezing at all costs.

- H. Tissue which is thawed and then refrozen almost always dies. Consequently, the decision to thaw the frostbitten tissue in the field commits the provider to a course of action which may involve pain control, maintaining warm water baths at a constant temperature, and protecting the tissue from further injury during rewarming and eventual transport. If rewarmed in the field, frostbitten extremities cannot be used for ambulation.
- I. In most cases, the patient should be transported as promptly as circumstances allow. When frostbite is mild and is not complicated by other injuries, and there are resources available to care for the patient without transport, it may be appropriate not to transport the patient to a medical facility. This should only be done in consultation with a physician who is knowledgeable about the treatment of frostbite. The decision not to transport should be carefully documented by the prehospital provider, as with any such decision.

J. Cautions:

1. do not rub the frozen part;
2. do not allow the patient to have alcohol or tobacco;
3. do not apply ice or snow;
4. do not attempt to thaw the frostbitten part in cold water;
5. do not attempt to thaw the frostbitten part with high temperatures such as those generated by stoves, exhaust, etc.; and
6. do not break blisters which may form.

K. Frostbitten tissues should be handled extremely gently before, during, and after rewarming.

L. When moving patients with frostbite by helicopter, care must be taken to protect the patient from additional exposure to cold due to the increased windchill caused by rotorwash. Rotorwash can be minimized if the helicopter shuts down while loading and unloading. If this is unsafe from an aviation standpoint, the patient must be packaged carefully to avoid any additional loss of heat or skin exposure that can cause or worsen frostbite and hypothermia.

# FROSTBITE

## *First Responder/Emergency Medical Technician-I, II, III/Paramedic Small/Bush Clinic*

### Evaluation and Treatment

- A. Anticipate, assess and treat the patient for hypothermia, if present.
- B. Assess the frostbitten area carefully since the loss of sensation may cause the patient to be unaware of soft tissue injuries in that area.
- C. Obtain a complete set of vital signs and the patient's temperature.
- D. Obtain a patient history, including the date of the patient's last tetanus immunization.
- E. If there is frostbite distal to a fracture, attempt to align the limb unless there is resistance. Splint the fracture in a manner which does not compromise distal circulation.
- F. Determine whether rewarming the frostbitten tissue can be accomplished in a medical facility. If it can, transport the patient while protecting the tissue from further injury from cold or impacts.
- G. If the decision is made to rewarm frostbitten tissue in the field, you should prepare a warm water bath (99° - 102 °F / 37-39 °C)<sup>6</sup> in a container large enough to accommodate the frostbitten tissues without them touching the sides or bottom of the container.

Generally patients with frostbite do not require opiates for pain relief; they occasionally need non-opiate pain medication or anxiolytics. If possible, consult a physician regarding the administration of oral analgesics, such as acetaminophen, ibuprofen or aspirin.

In immersion or combined injury there is so much edema, and high pain levels patients may need opiate pain medications for initial treatment. In this case, advanced life support personnel should administer morphine or other analgesics in accordance with physician signed standing orders or on-line medical control.

- H. A source of additional warm water must be available.
- I. Remove jewelry and clothing, if present, from the affected area.
- J. Water should be maintained at approximately 99-102 °F (37-39 °C) and gently circulated around the frostbitten tissue until the distal tip of the frostbitten part becomes flushed.
- K. Pain after rewarming usually indicates that viable tissue has been successfully rewarmed.
- L. After rewarming, let the frostbitten tissues dry in the warm air. Do **not** towel dry.
- M. After thawing, tissues that were deeply frostbitten may develop blisters or appear cyanotic. Blisters should not be broken and must be protected from injury.
- N. Pad between affected digits and bandage affected tissues loosely with a soft, sterile dressing. Avoid putting undue pressure on the affected parts.

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<sup>6</sup> Please note that the new temperatures are lower than previously recommended, this decreases pain for the patient, while only slightly slowing rewarming.

- O. Rewarmed extremities should be kept at a level above the heart, if possible.
- P. Protect the rewarmed area from refreezing and other trauma during transport. A frame around the frostbitten area should be constructed to prevent blankets from pressing directly on the injured area.
- Q. Do not allow an individual who has frostbitten feet to walk except when the life of the patient or rescuer is in danger. Once frostbitten feet are rewarmed, the patient becomes nonambulatory.

# FROSTBITE

## *Hospital*

The following section covers general points and gives an overview of hospital treatment for frostbite. This section is not intended to give complete information. Medical care providers who are not experienced in the management of frostbite should consult a physician who regularly manages frostbite and should consider transfer of the patient to a facility experienced in the care of frostbite after the patient has been stabilized, if possible.

### Evaluation and Treatment

- A. Anticipate, assess and treat the patient for hypothermia, if present. Treat moderate to severe hypothermia before treating the frostbitten areas, but don't take so long that the extremities thaw spontaneously. It is possible to thaw the extremities in many cases of hypothermia simultaneously by combining peritoneal dialysis with rapid rewarming in a tub.
- B. Assess the frostbitten area carefully since the loss of sensation may cause the patient to be unaware of soft tissue injuries in that area.
- C. Obtain a complete set of vital signs and the patient's temperature.
- D. Obtain a patient history, including the date of the patient's last tetanus immunization if possible. Give anti-tetanus therapy when indicated.
- E. Remove jewelry and clothing, if present, from the affected area.
- F. Water should be maintained at approximately 99-102°F (37-39°C) and gently circulated around the frostbitten tissue until the distal tip of the frostbitten part becomes flushed.<sup>7</sup>
- G. Pain after rewarming usually indicates that viable tissue has been successfully rewarmed.
- H. Pain relief:
  - Generally patients with frostbite do not require opiates for pain relief; they occasionally need anxiolytics or aspirin.
  - Sympathectomy has been performed in some patients. Patients who received sympathectomy have reported less pain, had a marked decrease in swelling, and tissue separation occurred earlier and was more distal. Treatment with this method is still controversial and the results are variable.
  - In immersion injury or combined injury there is so much edema, and high pain levels patients may need epidural blockade (occasionally for several days).
- I. After re-warming, let the frostbitten tissues dry in the warm air. Do **not** towel dry.
- J. After thawing, tissues that were deeply frostbitten may develop blisters or appear cyanotic.
- K. Do not allow an individual who has frostbitten feet to walk except when the life of the patient or rescuer is in danger. Once frostbitten feet are rewarmed, the patient becomes nonambulatory.

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<sup>7</sup> Please note that the new temperatures are lower than previously recommended, this decreases pain for the patient, while only slightly slowing rewarming.



L. Wound Care:

- After thawing - if the injury is deep - use sterile sheets with cradles over extremity to prevent additional trauma. Cotton pledgets between affected fingers/toes without excessive pressure on the digital vessels helps prevent decreased circulation.
- The clinician must decide if the extremity should be elevated (eg. hanging frostbitten arms in stockinette dressings) to reduce swelling or kept at the level of the heart to assist blood flow in the small arterioles. Avoid keeping the tissues in a dependent position. Examine the blood flow into the extremity at consistent intervals.
- Blisters are generally left intact (usually sterile). Some experts aspirate small blisters that contain reddish or bluish material using sterile technique to remove toxins.
- Treatment is open; no wet dressings, ointments, occlusive dressings etc. If the patient has severe pain silver nitrate, 0.5% can be used on the frostbitten area. If there are open wounds secondary to the freezing injury 1% silver sulfadiazine cream may be used.
- Whirlpool baths twice daily. The water temperature should be body temperature (98°F / 37°C) which allows the part to be cleansed and removes superficial bacteria without surgical debridement. Surgical soaps should be used in the baths (e.g. Betadine<sup>®</sup>, etc.).
- When an eschar (scab) forms (usually on day 10-14), it is split manually to relieve stiffness. Patients should perform bedside exercises of all small joints.
- Delay debridement or amputations for at least 21 days; unless it is absolutely necessary. There is less tissue retraction after this time (premature amputation may cause the loss of up to 3-5 cm)
- Cover the wounds as soon as possible with split thickness (mesh) skin grafts
- Antibiotics are not usually necessary unless deep infection is diagnosed.
- Hyperbaric oxygen has not yet been shown to be beneficial in the final outcome of frostbite, but may hasten wound healing.

M. If the lower extremity is frozen for a great length of time, the patient may develop a compartment syndrome, most commonly in the anterior tibial compartment and the foot. If compartment pressures are greater than 37-40 mm Hg, the skin may need to be split or the patient may require a fasciotomy. Delay in performing fasciotomies can be disastrous.

N. Technetium <sup>99</sup> studies can be useful to determine blood supply (doppler ultrasound is not as useful).

O. Smoking is discouraged as it causes small arterioles to constrict; alcohol is permitted.

P. Biofeedback may increase hand and foot circulation.

Q. Dibenzyline 10 mg, once daily which can be increased up to 20-60 mg helps to treat vasospasm and is a very effective alpha-adrenergic blocking agent.

R. TPA has not been found to be useful in these patients.

S. If there are associated fractures and dislocations:

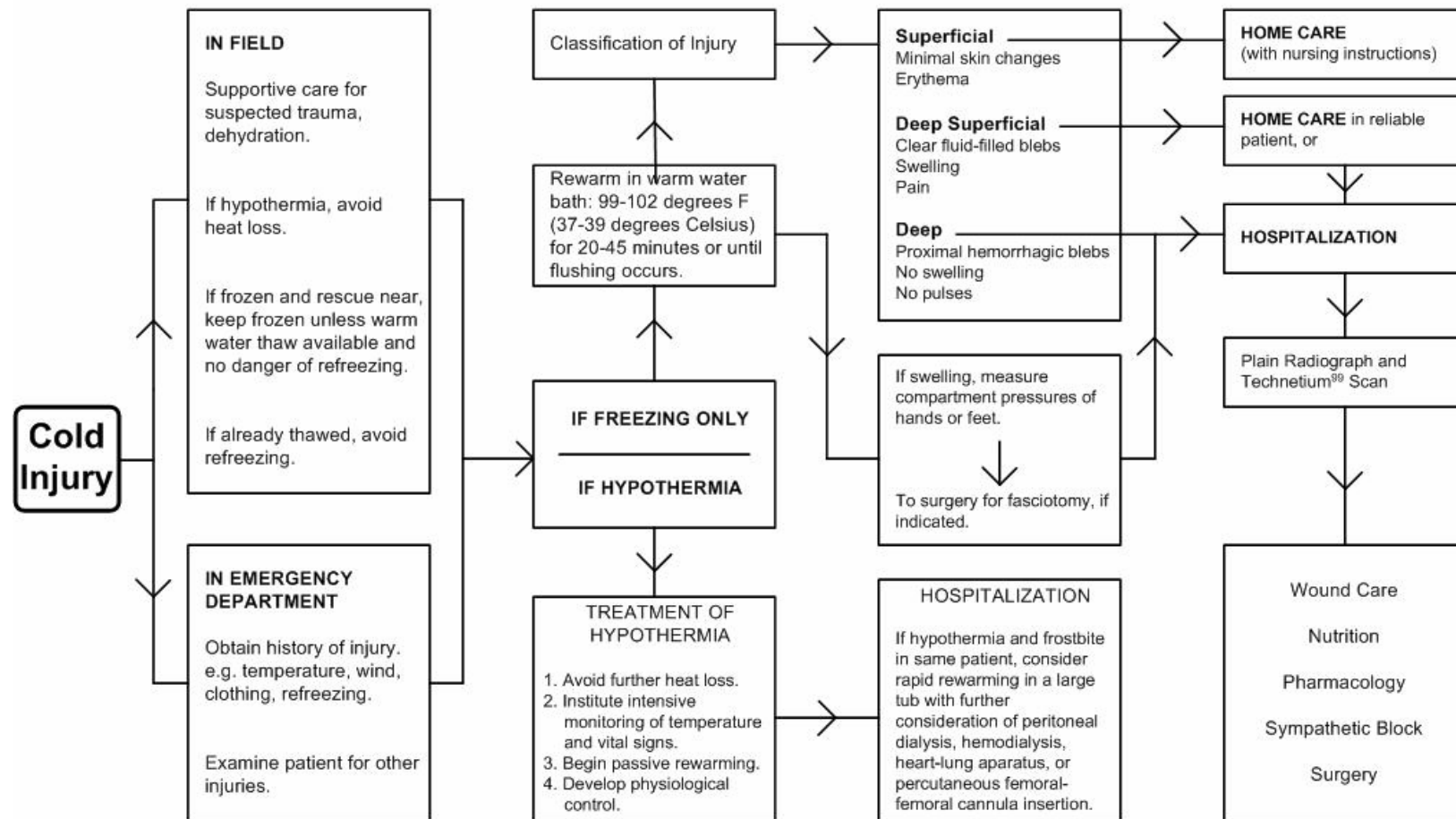
- Reduce dislocations immediately after thawing.
- Fracture treatment conservatively until thawed and placed in splint. Reduction or open

reduction can be done afterwards. These people tend to do poorly as the vascular blood supply was embarrassed twice.

- T. Children's' cartilage is more susceptible to cold injury. This is especially true in the carpal and tarsal bones. This is due to the epiphyseal growth plates being still open. Injury may occur in a child at any age where the cartilage still persists.
- U. If treatment has failed and an amputation is needed, do modified guillotine amputations, even in the digits.

## ALGORITHM FOR TREATMENT OF FROSTBITE

### The Alaskan Method



SOURCE: O' Malley J., Mills WJ., Kappes B., Sullivan S., Frostbite: General and Specific Treatment The Alaskan Method. *Alaska Med.* 1993, 35:1 (pull out)



# AVALANCHE RESCUE

## *Introduction*

- A. Overall, 80% of avalanche deaths are caused by asphyxia, 10-15% by injuries and only 5% by hypothermia.
- B. In the most detailed avalanche burial study to date, with 422 victims, there was an overall survival of 43%<sup>8</sup>. The chance of survival was 92% if the victim was uncovered within 15 minutes of burial. However between 15-35 minutes after burial, survival dropped rapidly to only 30%. Between 35 and 90 minutes the slope of the survival curve became almost horizontal, but after 90 minutes it dropped again so that the survival rate was only 3% by 130 minutes.
- C. The initial survival of 92% in the first 15 minutes is higher than previously thought. Of the 123 victims extricated within 15 minutes, only 8 were dead, of which only 2 had died of asphyxia. The remaining 6 died of fatal injuries. The rapid decline in survival over the next 20 minutes (15 to 35 minutes from the time of burial) reflects asphyxiation, mainly of victims without an air pocket. The horizontal slope of the survival curve between 35 and 90 minutes indicates the low risk of dying during this period for victims still alive, with an air pocket. The insulation provided by the snow prevents rapid development of hypothermia. The increased decline in survival after 90 minutes reflects victims starting to die because the air pocket is not open to the outside.
- D. In order to extricate a victim within the optimal 15 minute period after burial, the victim must be located and extricated by companions. It takes too much time to notify, mobilize, and bring trained avalanche rescuers to the scene. Backcountry travelers should know the techniques of avalanche search and rescue, should carry shovels, collapsible probes, and avalanche transceivers, and should know how to use them. They also should be taught the importance of an air pocket and how to create one if caught in an avalanche. However, since possession of this information and these skills may create a false sense of security, it is even more important to be able to recognize and avoid dangerous avalanche terrain and conditions.

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<sup>8</sup> Falk, M., Brugger, H., Adler-Kastner, L. (1994) Avalanche survival chances. Nature 368:21.

# AVALANCHE RESCUE

## *General Points*

- A. An avalanche incident is a medical emergency. Because of the high survival in people extricated within 15 minutes, and the rapid decline in survival over the next 20 minutes, the victim must be located and extricated by companions. People on site should start a quick search for victims as soon as the area is safe. Search for 15 minutes before sending someone for help. However, if a radio or cell phone is readily available, the call for help can be made as soon as is practical.
- B. Try to transport medical personnel and search dogs with handlers to the scene as quickly as possible, especially if it has been less than 90 minutes from the time of the avalanche. However, scene safety is the first consideration. An experienced avalanche safety person must secure the scene before other rescuers can begin on-site operations.
- C. Victims buried for less than 35 minutes should be extricated as rapidly as possible. If the person is in critical condition it is either because of acute asphyxia or trauma. After a complete burial (head and trunk buried), the person should be transported to a hospital and admitted for observation.
- D. Victims buried for more than 35 minutes may be hypothermic. They should be extricated as gently as possible.
- E. An air pocket is necessary for survival. Rescuers should look for an air pocket, which is any opening around the mouth or nose. Only if both the mouth and nose are completely blocked is there no air pocket.
- F. Treatment of patients in asystole depends upon estimated duration of burial, core temperature and presence of an air pocket.

Patients who have been buried for less than 35 minutes are presumed not to be hypothermic. If they are pulseless it is due to asphyxia or to trauma. CPR should be performed for 30 minutes.

Patients buried for more than 35 minutes are presumed to be hypothermic. If there was no air pocket, CPR should not be performed. If an air pocket was present or uncertain (possible present), the decision to perform CPR is made in accordance with hypothermia guidelines. If core temperature can be measured and it is greater than 90 °F (32 °C), standard ACLS protocols are followed.
- G. Hypothermia should be treated according to the hypothermia guidelines.
- H. Trauma should be treated according to trauma guidelines.

# AVALANCHE RESCUE

## *General Public*

### Evaluation and treatment

- A. Prevention is the most effective measure to increase avalanche survival.
- B. If someone is caught in an avalanche the best means of increasing survival is rescue by other members of the party. Every member of the party should have a shovel, a collapsible probe, and an avalanche beacon and should be trained in the use of the beacon.
- C. If a patient is pulseless (after a check for 60 seconds) and burial time is estimated to be less than 35 minutes, perform CPR for 30 minutes
- D. If a patient is pulseless (after a check for 60 seconds) and burial time is estimated to be more than 35 minutes and if an air pocket is present or uncertain, perform CPR. If there is no air pocket – do not perform CPR.
- E. Assess carefully for associated injuries. Follow the Trauma Guidelines.

# AVALANCHE RESCUE

## *First Responder/Emergency Medical Technician-I*

### Evaluation and treatment

- A. Prevention is the most effective measure to increase avalanche survival.
- B. If someone is caught in an avalanche the best means of increasing survival is rescue by other members of the party. Every member of the party should have a shovel, a collapsible probe, and an avalanche beacon and should be trained in the use of the beacon.
- C. If a patient is pulseless (after a check for 60 seconds) and burial time is estimated to be less than 35 minutes, perform CPR for 30 minutes.
- D. If a patient is pulseless (after a check for 60 seconds) and burial time is estimated to be more than 35 minutes and if an air pocket is present or uncertain, perform CPR. If there is no air pocket – do not perform CPR.
- E. Assess carefully for associated injuries. Follow the Trauma Guidelines
- F. Hypothermia, if present, should be treated according to the section on Hypothermia for the EMT-I.



# AVALANCHE RESCUE

## ***Emergency Medical Technician-II; Emergency Medical Technician-III; Paramedic***

### Evaluation and treatment

- A. Prevention is the most effective measure to increase avalanche survival.
- B. If someone is caught in an avalanche the best means of increasing survival is rescue by other members of the party. Every member of the party should have a shovel, a collapsible probe, and an avalanche beacon and should be trained in the use of the beacon.
- C. If a patient is pulseless (after a check for 60 seconds) and burial time is estimated to be less than 35 minutes, perform CPR for 30 minutes
- D. If a patient is pulseless (after a check for 60 seconds) and burial time is estimated to be more than 35 minutes and there is no air pocket – do not perform CPR. If an air pocket is present or uncertain, perform CPR. Begin with ventilation. Measure temperature and begin cardiac monitoring. If the patient is not hypothermic follow standard ACLS protocols. If the patient is hypothermic, treat according to hypothermia guidelines.
- E. Assess carefully for associated injuries. Follow the Trauma Guidelines
- F. Hypothermia, if present, should be treated according to the Hypothermia section at the appropriate level.
  - 1. If the main problem is not moderate-to-severe hypothermia, medication should be used as in the normothermic patient
  - 2. Fluid therapy should be given as indicated but never at a “to keep open” rate, which may result in a frozen IV line. Boluses of warm fluid should be given as needed.

# AVALANCHE RESCUE

## *Small Bush Clinic*

### Evaluation and treatment

- A. If a patient is pulseless (after a check for 60 seconds) and burial time is estimated to be less than 35 minutes, perform CPR for 30 minutes
- B. If a patient is pulseless (after a check for 60 seconds) and burial time is estimated to be more than 35 minutes and if an air pocket is present or uncertain, perform CPR. If there is no air pocket – do not perform CPR.
- C. Assess carefully for associated injuries. Follow the Trauma Guidelines.
- D. Follow the Small/Bush Clinic section on Hypothermia for additional therapy as needed.
  - 1. If the main problem is not moderate-to-severe hypothermia, medication should be used as in the normothermic patient
  - 2. Fluid therapy as indicated.

# AVALANCHE RESCUE

## *Hospital*

### A Evaluation

The evaluation of the avalanche victim should be directed towards treating specific injuries and conditions, including hypothermia, if present. Special attention should be directed towards possible complications of asphyxia as in the Hospital Section of the Cold Water Near Drowning Guidelines. Evaluation of hypothermia is generally the same as that indicated in the Hospital Section of the Hypothermia Guidelines

### B. Treatment

As in the Hospital Section Cold Water Near Drowning Guidelines

## 24 HOUR PHYSICIAN-STAFFED EMERGENCY DEPARTMENTS

For more information, contact the nearest referring medical facility or one of the following:

### **INTERIOR REGION**

Fairbanks Memorial Hospital, Fairbanks – 1.907.452.8181

### **SOUTHERN REGION**

Alaska Native Medical Center, Anchorage – 1.907.279.1729  
Central Peninsula General Hospital, Soldotna – 1.907.262.4404  
Alaska Regional Hospital - Alaska, Anchorage, - 1.907.276.1131  
Providence Hospital, Anchorage – 1.907.562.2211  
Valley Hospital, Palmer – 1.907.746.8600

### **SOUTHEAST REGION**

Bartlett Regional Hospital, Juneau – 1.907.586.2611  
Ketchikan General Hospital – 1.907.225.5171  
SEARHCH Mt. Edgumbe Hospital – 1.907.966.2411

## **APPENDIX A: MEDICAL EQUIPMENT FOR THE HYPOTHERMIC PATIENT**

The State of Alaska and the Section of Community Health and EMS are not endorsing the purchase or use of a particular make or model of temperature monitoring or rewarming device.

A partial list of some types of hypothermia equipment (e.g. esophageal probes, epitympanic probes, etc.) is available on the CHEMS website to assist an EMS service, clinic or hospital in locating the types of devices suggested by these guidelines.

[www.chems.alaska.gov](http://www.chems.alaska.gov)

## APPENDIX B: SUGGESTED READING LIST

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## TEMPERATURE CONVERSIONS

$$\text{Centigrade} = \left( \frac{\text{Fahrenheit} - 32}{9} \times 5 \right)$$

$$\text{Fahrenheit} = \left( \left( \frac{9 \times \text{Centigrade}}{5} \right) + 32 \right)$$

Centigrade	Fahrenheit
44.0	111.2
43.0	109.4
42.0	107.6
41.0	105.8
40.0	104.0
39.0	102.2
38.0	100.4
37.0	98.6
36.0	96.8
35.0	95.0
34.0	93.2
33.0	91.4
32.0	89.6
31.0	87.8
30.0	86.0
29.0	84.2
28.0	82.4
27.0	80.6
26.0	78.8
25.0	77.0
24.0	75.2
23.0	73.4
22.0	71.6
21.0	69.8
20.0	68.0
19.0	66.2
18.0	64.4
17.0	62.6
16.0	60.8
15.0	59.0
14.0	57.2
13.0	55.4
12.0	53.6
11.0	51.8
10.0	50.0

Fahrenheit	Centigrade	Fahrenheit	Centigrade
110.0	43.3	79.0	26.1
109.0	42.8	78.0	25.6
108.0	42.2	77.0	25.0
107.0	41.7	76.0	24.4
106.0	41.1	75.0	23.9
105.0	40.6	74.0	23.3
104.0	40.0	73.0	22.8
103.0	39.4	72.0	22.2
102.0	38.9	71.0	21.7
101.0	38.3	70.0	21.1
100.0	37.8	69.0	20.6
99.0	37.2	68.0	20.0
98.0	36.7	67.0	19.4
97.0	36.1	66.0	18.9
96.0	35.6	65.0	18.3
95.0	35.0	64.0	17.8
94.0	34.4	63.0	17.2
93.0	33.9	62.0	16.7
92.0	33.3	61.0	16.1
91.0	32.8	60.0	15.6
90.0	32.2	59.0	15.0
89.0	31.7	58.0	14.4
88.0	31.1	57.0	13.9
87.0	30.6	56.0	13.3
86.0	30.0	55.0	12.8
85.0	29.4	54.0	12.2
84.0	28.9	53.0	11.7
83.0	28.3	52.0	11.1
82.0	27.8	51.0	10.6
81.0	27.2	50.0	10.0
80.0	26.7		

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